Encyclopædia
of Wild Medicinal Plants in Egypt

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Solanum nigrum
Teucrium polium
Pluchea dioscoridis
Solenostemma arghel

Edited by

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Conservation and Sustainable Use of Medicinal Plants
in Arid and Semi-arid Ecosystems in Egypt
2005

First published 2005

4 Ali Kourdy Str., Maadi, Cairo
Tel.: (202) 5274700

Legal Deposit Number: 2006/2528
ISBN Number: 977-5089-65-4

Printed by:
The Palm Press
34, Mansour Muhammed St.,Zamalek,
Cairo 11211, Egypt
Tel.:736-5458, 735-9867 Fax: 735-9868
Email: info@ thepalmpress.com

For citation:
Name of the compiler of the monograph. 2005. Name of the plant species, pp. ..-... In: Batanouny, K.H. (Edit.). Encyclopædia of Wild Medicinal Plants in Egypt, Vol. 1. Project of: Conservation and Sustainable Use of Medicinal Plants in Arid and Semi-arid Ecosystems in Egypt. EEAA, GEF and UNDP.

FOREWORD

As early as 3000 B.C., the ancient Egyptians put much confidence in plants for curing their diseases. Up till now, the same confidence still exists among the contemporary Egyptians and a "turn back" to "remedy by herbs" is now becoming a global rather than regional or national request. Many pharmacopoeial plants have been used since a long time in folk medicine. Some of them have been reported in the Ebers Papyrus.

The list of medicinal plants in Egypt is not well-defined till now. The recent study by Batanouny (1999) is an inventory of the wild medicinal plants in Egypt. It gives a brief history of the use of these plants in the country. The plants were classified into three groups: the pharmacopoeial plants (13 Species), plants used in folk medicine and usually sold by *Attarin* and herbalists (39 Species) and plants of potential medicinal value (79 Species). Since the publication of Batanouny's study in 1999, one can state that there are other species which came into use in folk medicine. This is referred to wider geographical investigations, more knowledge about the plants used locally in some places and the introduction of new species to the list. Parallel to the increase in number, there have been knowledge and information about the medicinal plants added. This is due to new phytochemical, pharmacological investigations. Moreover, the launching of the project of: "Conservation and Sustainable Use of Medicinal Plants in Arid and Semi-arid Ecosystems" initiated a lot of studies and investigations of the wild medicinal plants from different aspects and by scientists from different disciplines. Meetings during the activities of this project gathered hundreds of scientists and researchers in different disciplines related to medicinal plants. The knowledge and information about medicinal plants become substantial.

Depending on the information about the folk use of some plants as well as on the recorded uses in the heritage and old treatises by scholars, many wild plants in Egypt were investigated for their active constituents. These investigations began with the establishment of the Egyptian University, especially the School of Medicine. The establishment of the National Research Centre in

the mid-fifties of the last century and its units of phytochemistry, medicinal plants, natural products, pharmacology and pharmaceutics was the prominent start in the study of wild medicinal plants. The departments of Pharmacognosy in the Faculties of Pharmacy, those of Chemistry and Botany in the Faculties of Science in the Egyptian Universities contributed a lot to our knowledge of wild medicinal plants.

Studies on the cultivation and propagation of wild medicinal plants are still fragmentary. However, the editor of the present Encyclopaedia succeeded in the propagation of more than 40 wild species in the Centre for the Conservation of Threatened Plants at El Hammam, North Coastal Zone, Egypt (IUCN project). The present project started propagating about 38 species in nurseries and farms in St. Katherine, Sinai. It is hoped that these trials succeed in establishing guidelines for the propagation of wild medicinal plants as an *ex situ* conservation and for production for use in pharmaceutical industry.

The information and data about wild medicinal plants are scattered. So, it has been evident that there is a great need to compile these data into an Encyclopaedia. The project gathered interested eminent researchers and University staff members and they were requested to implement the compilation of all available information about he wild medicinal plants. Guidelines for the compilation of monographs for medicinal plants were designed by the editor. In fact, all the types of monographs available were consulted. The folk medicinal uses of the plants in Egypt were recorded.

As it is too difficult to have all monographs at the same time, and to be arranged by any criteria, the ready monograph will be published without any particular arrangement or classification. So, the encyclopaedia will appear in separate numbers depending on the availability of the monographs. One number may have one or more monographs. It is hoped that after finishing all the monographs, they will be re-arranged and printed in one or more volumes. When a reasonable number of monographs will be printed, one volume will be given to a glossary of the technical and medical terms used all over the encyclopaedia. Another volume will be for the indices and plant names.

It is hoped that this encyclopaedia will not only allow researchers, decision makers and all stakeholders to know about this important issue of the wild medicinal plants, but will also set forth action for its conservation and its sustainable use. Moreover, it is expected that it will support the issuing of national legislations for the protection of the relevant Intellectual Property Rights.This will support beneft sharing. The information given in the monographs is expected to inspire the persons responsible for the drug industry in the country to make use of the wild medicinal plants.

It is hoped that the data given in the monographs will support the establishment of standardization schemes for the used drugs. This might support the prescription of these drugs by doctors and physicians.

The monographs will be supplemented and updated periodically as new information appears in the literature and additional monographs will be prepared.

The appearance of these monographs would not be realized except through the continuous support of many persons and institutions. To all of them I wish to express my sincere gratitude. Special thanks are due to Dr. Mostafa Fouda (EEAA), Dr. Mohamed Bayoumi (UNDP) and Dr. Mohammed El Demerdash (Manager of the Project), Dr. Khaled Shams (National Research Centre) and Dr. Omar Abdel Dayem (Project Technical Officer). Sincere thanks are due to the donors(GEF and UNDP) for their generous funds to the project.

Giza, December 4, 2005

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SOLANUM NIGRUM L.

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SOLANUM NIGRUM L.

Enab ed-dib









Solanum nigrum L., Sp.Pl., ed. 1, 186 (1753).

var. **nigrum**
var. **incisum** Täckh. & Boulos, publ. Cairo Univ. Herb. 5: 101, f. 16a (1974).
var. **elbaensis** Täckh. & Boulos, publ. Cairo Univ. Herb. 5: 102, f. 16b (1974).

Names

Arabic: Enab ed-dib عنب الديب
Enab et-ta,leb عنب الثعلب
English: Black nightshade, Hound's berry
French: Morelle noire, Crève chien
German: Schwarze Nachtschatte

Solanum is the old name given by Pliny, the Roman naturalist, possibly derived from Latin solamen = solace or comfort, alluding to its calmative properties.
Nigrum means black, referring to the colour of the fruit.

Morphological Description

Solanum nigrum L.,

var. **nigrum**

Erect annual to 70; stems terete, branched, glabrescent to villose, with glandular and glandular hairs; leaves 3-7 x 1.5-3.5 cm, ovate- lanceolate, entire or dentate; flowers 5-10 in simple lax cymes; pedicel lobed; corolla 1-1.4 cm diam., white, rather deeply lobed; berry 0.6-1 cm, spherical, glossy, black.

var. **incisum**

Sharply incised-dentate leaves.

var. **elbaensis**

Leaves cut half-way round, with sinuses between the acute or obtuse lobes.

Part used

The plant is used either as a whole or in a separated parts e.g. the leaves, stems, roots, unripe fruits and ripe fruits. The content of the different chemical compounds e.g. glyco-alkaloids, sapogenins and flavonoids depends on the age of the plant organ and also the environmental conditions.

Geographical distribution

Global

Solanum nigrum has been reported in Bahamas Belgium, China, Dominican Republic, Bolivia, Brazil, Colombia, Costa Rica, El Salvador, France, Guiana, Guatemala, Honduras, India, Peru, Suriname, Pakistan, Spain, Philippines, Trinidad and Tobago

Arab countries

Solanium nigrum is recorded in all the Arab countries.

Local

var. **nigrum:** N, O, M, D, S; weed of cultivation. Cosmopolitan in temperate regions.
var. **incisum:** N, common in the Nile valley, especially to the south
var. **elbaensis:** GE; sandy soil. Endemic

Abbreviations

N: The Nile region including the delta, valley and Faiyum.

O: The oases of the Western Desert: Wadi Natrun, Siwa, Farafra, Bahariya, Kharga, Dakhla, Kurkur, Dungul and Uweinat.

M: The Mediterranean coastal strip from the border with Libya near Sollum to Port Said.

D: All the deserts of Egypt except that of Sinai.

S: Thc entire Sinai peninsula including the coastal Mediterranean strip and El-Tih Desert east of Suez Canal.

Ge: Gebel Elba and the surrounding mountainous region.

Ecology

The varieties belonging to the black nightshade are widely distributed in various habitats throughout the world, from tropical to temperate regions and from sea level to altitudes exceeding 3500 m. Their wide tolerance of habitat types, their ability to flower while still young and their prolific seed production all contribute to the success of these varieties as widespread weeds.

The plant is found in disturbed habitats, such as roadsides, often on arable land especially the edges of cultivated fields and plantations, in hedgerows, on railway cuttings, quaysides and rubbish tips, in areas around buildings and houses, under trees, on forest and grassland margins, as garden weeds, on shingle beaches, riverbanks and in gullies. The plant is tolerant to dry soils and high summer temperature. S. nigrum var. elbaensis grows only on sandy soil and is found in Wadi Yahmib, Gabal Elba.

Status

Solanum nigrum plant is widespread and is not endangered. It is still regarded as wild, weedy and semi domesticated plant. *S. nigrum* grows as wild and weedy plant in various parts of Egypt. The whole plant is collected at fruiting stage after the full ripening of the fruits.

Storage

In view of the widespread occurrence of *S. nigrum* either as wild or as weed. Therefore, it is not necessary to store the herb for a long time.

The following conditions should be considered through the processing of the herb before storage:

- Drying must be carried out directly after collection.

- After complete dryness, moisture content does not exceed than 6 %.
- The dried herb must be free from stones, sand and animal remains

If the herb will be stored, it must be stored in special containers e.g. sacks, bales, cardboard boxes or paper bags under the following conditions:

- The wall and floor must be very clean
- Good ventilated and shaded
- The herb must be protected from insects, mice and birds.

Chemical Constituents

Glyco-alkaloids:

The whole plant contains solanine, solasodine, solamargine and ß - solamargine.

Young immature fruits contain 4.25% total glyco-alkaloids.

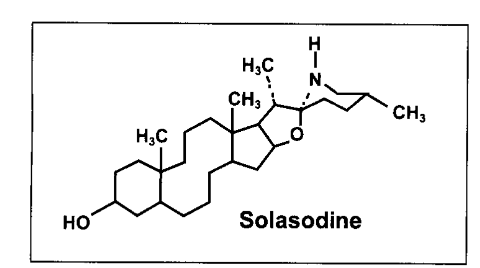
The steroidal alkaloid solanidine found in unripe fruits in amount of about 0.004 % and absence in the ripe fruits.

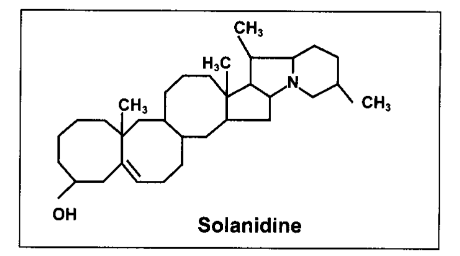
The roots were reported to contain 0.02% solasodine.

Solasodine content varies from 0.3% in leaves, nil in roots and ripe fruits to 6.3% in unripe fruits.

The concentration of solasodine in roots was higher than in stems, also the heighest level was found in the unripe fruits

Chemical structure of the steroidal alkaloids:





Glyco-alkaloids:

Solanine:

Solanidine + L.rhamnose,D.glucose and D.galactose.

Solasonine:

Solasodine + D.glucose, D.galactose and L.rhamnose.

Solamargine:

Solasodine + D.glucose, L.rhamnose and L.rhamnose.

ß - Solamargine:

Solasodine + D.glucose, L.rhamnose.

Sapogenins:



Tigogenin content in whole plant is about 0.5%. Diosgenin content is about 1.2%.

Desgalactotigonin together with the glucoside 26-*O*-(ß-D-glucopyranosyl) 22-methoxy-ZI-D-5α-furost-3 ß,26-diol 3-*O*-ß-lycotetraoside was isolated from the immature berries.

The roots and stems contain another spirostanoside (uttronin B,$C_{39}H_{64}O_{12}$) which gave on acid hydrolysis diosgenin and D-glucose and L-rhmnose.

One spirosternol glycoside and two furostanol glycosides isolated from stems and roots and identified as :

3-*O*-ß-lycotetraosyl)-(25R)-5α -spirostan-3 ß-ol (uttronin A).

3-*O*-(ß- lycotetraosyl)-26-*O*-(ß-D-glucopyranosyl)-(25R)- 22α -methoxy-5d-furostane-3 ß-diol (uttronin A).

3-*O*-(ß- lycotetraosyl)-26-*O*-(ß-D glycopyranosyl)- (25R)-5α - furostane-3 ß,22α, 2b-triol (uttroside B).

Flavonoids :

Six flavonoids were identified from leaves as follows:

1- Quercetin 3-*O* -(2-α- rhamnosyl)- ß-glycosyl (1→6)- ß-galactoside.
2- Quercetin 3-*O* -α - rhamnosyl (1→2)- ß-galactoside.
3- Quercetin 3-glucosyl (1→6)galactoside.
4- Quercetin 3-gentiobioside.
5- Quercetin 3-galactoside.
6- Quercetin 3-glucoside.

The steroidal oligoglycosides nigrumnins I and nigrumnins II were isolated from the whole plant. The seeds contain from 20-30% fixed oil. 150 kDa glycoprotein was isolated from seeds, fruits and stems.

Folk Medicinal Uses & Traditional Knowledge

No information was recorded about the utilization of *S. nigrum* in the recent Egyptian folk medicine. However, the following review include a wide and spectrum use in folk medicine in other countries.

S. nigrum has been used in Europe as a remedy for convulsions, and administrated as a soporific in Germany especially for children, which leaves being placed in babies' cradles to promote sleep in Bohemia (Czech Republic).

The bruised fresh leaves used externally to ease pain and reduce inflammation, they are applied to burns and ulcers by the Arabs. Leaves juice have also been used for ringworm, gout and earache, while it is also reported to be a good gargle and mouth wash when mixed with vinegar.

In north America, the Houmas Indians use an infusion made from boiled roots of S. nigrum to administer to babies with worms, and crushed green leaves mixed with a grease to make poultices for sores, while the Rappahannock used a weak infusion to cure insomnia.

In India, the plant is noted for its antiseptic and antidysenteric properties and is given internally for cardalgia and gripe. An infusion of the plant is used as an enema for infants with abdominal upsets. The plant is also a household treatment for anthrax pustules when it is applied locally. It is further reported to have emollient, diuretic and laxative properties.

Freshly prepared extracts of the plant are apparently effective in the treatment of cirrhosis of the liver and also serve as an antidote to opium poisoning. An alcoholic extract of leaves is active against *Staphylococcus aureus* and *Escherichia coli*. The seeds are reportedly used to treat gonorrhoea and dysuria.

In Pakistan, a powder from the aerial parts of the plant could be antiulcerogenic.

In China, leaves are used as a febrifugal or detoxicant drug. The dried aerial parts of plants which are used as a diuretic, antihypertensive and anticancer agent for infections of the urinary system, hypertension and cancer of the digestive system.

In Japan and East Africa, the immature fruits show considerable anticancer activity. In Philippines, the fruits and juices of *S. nigrum* are used to cure stomach ailments, fevers and blood impurities and young shoots to cure skin diseases. Also, the leaf extracts are apparently used to restore body skin pigment.

Heritage Resources

The plant has been mentioned in the following traditional heritage books:

Ibn El-Bietar under the name of Enab El-zeab عنب الذئب he recorded that the plant act as hypnotic and as hallucination agent. He mentioned also that the powder of leaves or whole plant is used in treating headache, gastralgia and to treat uterus discharge as vaginal suppository.

Al- Ghassani, under the name of Enab Etheilab mentioned that, there are two kinds; Hab El-Lahw حب اللهو and Ghalya غاليا which grows wild in the mountain بري جبلي and after the complete ripping of its fruits become

red in color. He recorded that, the whole plant is used as antipyretic and congastant. Also, the paste from leaves is used in the treatment of eyes inflammation. The whole plant treats cellulitif or when mixed with the salt used in treatment of the ear tumors or when the powdered leaves mixed with rose oil used in treatments of tumors in the boys heads.

El-Antaky mentioned that the boiled leaves or the whole plant are used in treatment of haemophtysis.

Waddee Gabr mentioned that the plant is used as narcotic and the juice of the ripe berries is used as teeth pain relieving.

Dr. Ahmed Zaher Amin mentioned that, the mixture from; *Solanum nigrum*, willow leaves, saffron and egg albumen in the form of ointment is used as demulcent.

Samir Yehya El-Gammal mentioned that, the decoctions of the whole plant are used as sedative demulcent, hepatotonic, cholagouge, ascitis remedy and in menstruation spasmolytic.

Diseases mentioned to be treated by *Solanum nigrum*
Ascitis, menstruation spasmolytic, stomach inflammation, uterus discharge, headache, gastritis haemophtysis and head tumors.

Ethnobotany

Sources of food:

Leaves and tender shoots are widely used as vegetables throughout the world and have provided a food source since early times, with *S. nigrum* being recorded as an ancient famine plant of the Chinese. The leaves and young shoots are boiled or stewed and used as a relish.

They are also used in soups and sauces such as palaver. All the species are used as pot-herbs or leaf/stem vegetables more or less throughout their respective geographical ranges in Africa, Asia, Malaysia and the Americas. Indeed, it was reported that the herbage of *S. nigrum* was considered to be a very valuable culinary vegetable in the Mauritius, and was imported to Australia by immigrants in the 1852 for use as a vegetable. Often the vegetable used is called 'spinach' and there are many ethnobotanical accounts of the water in which the vegetative parts have been boiled being discarded and replaced several times, or replaced with milk, to prevent the ingestion of toxins.

In Malawi, It was reported that potash (which is a filtrate collected from ashes of dried amaranth or bean plants) or soda, groundnut paste and salt are added to boiled leaves. These additives add taste and flavor to the diets. The vegetable is used in both urban and rural areas, but since it is often bitter it is mixed with *Amaranthus* spp., *Corchorus* spp. or with other green leafy vegetables.

In Kenya, boiled leaves of these Solanums are apparently recommended for pregnant women, since their consumption is believed to result in the birth of children with dark eyes and smooth skin. Moreover, pregnant women who eat this vegetable are believed to recuperate well after delivery. It is also believed that children eating the vegetable do not get 'marasmus' or 'kwashiokor', especially if the vegetable is cooked with milk, groundnuts (*Arachis hypogaea* L.) or sesamum (*Sesamum indicum* L.).



The South African berries must be cooked, for the toxicity of the green fruits. Indeed, most of the berry used as food must be ripe which are red, yellow, or purple. In India, the berries are eagerly sought out and eaten by children, and the berries of all species are eaten by a variety of bird species in all countries of their geographical ranges.

Nutritional value:

Several studies have been conducted to investigate the nutritive value of the vegetable black nightshades (*S. nigrum*). It is evident that these species constitute nutritious vegetables.

The leaves can provide appreciable amounts of protein and amino acids, minerals including calcium, iron and phosphorus, vitamins A and C, fat and fiber, as well as appreciable amounts of methionine, an amino acid scarce in other vegetables.

Moreover the berries can apparently yield high mounts of iron, calcium and vitamin B, and appreciable amounts of vitamin C and carotene. Also, the seeds contain vitamin C and carotene. The nutrient values may, however, vary with soil fertility. The leaf protein content of *S. nigrum* is dependent on the age of the plant. Moreover, the application of nitrogen increases the amount of ascorbic acid and protein while decreasing the calcium content in the leaves.

The values of available ascorbic acid depend on the method of cooking. Ascorbic acid content decreased with both an increase in the cooking time and in the volume of water used for cooking. 22 g of dried leaves of *S. nigrum* used as a wild vegetable in the Zambezian Woodland area in southern Central Africa yielded energy levels of 1232 kJ and 295 calories.

Potential value as crop plants:

Despite their reputed deleterious qualities, it is clear from the various documented uses of the vegetable 'black nightshades' that the species do exhibit many potentially valuable characteristics which deserve conservation and utilization.

Their 'more important features include: both the leaves and fruits are edible; the vegetative parts are highly nutritious and contain proteins, fiber, minerals and vitamins; the berries contain calcium, iron, carotene and vitamins B and C.

While the seeds also contain vitamin C and carotene; the plants can be grown on a small piece of land or simply in pots to provide a good harvest of berries for use in pies, jams and preserves or as a raw fruit; the species can be used as fodder for cattle and goats and browse for wild animals; the berries can be used as a dye and a food colourant.

The plants can provide a source of income for rural farmers; the plants can be harvested over a period of time; which could be beneficial in soil conservation when used in intercropping systems.

Studies in Java (Fortuin and Omta 1980) reported that *S. nigrum* is a source of several traits which might be useful in improving various economically important crops; these include: atrazine resistance, resistance to tobacco mosaic virus, resistance to potato late blight, resistance to Phomopsis fruit rot.

The species show potential molluscicidal activity; the species serve as alternative hosts for a variety of pests, bacterial and fungal pathogens of a number of commercial crops; they might therefore be of use as potential control agents.

Also, *S. nigrum* is used in soil phyto-remediation to remove heavy metals e.g. Cd, Pb Cu and Zn from contaminated soils. The plant showed a molluscidal and cercarisidal efficacy either alone or when combined with other plants.

Sources of fodder and browse:

S. nigrum is apparently used as fodder and browse by various animals, especially in Africa.

Herbarium records showed that plants are eaten by sheep and goats in the Sudan, and by bush-buck and browsed by goats and giraffe in Kenya.

The use of the black nightshades as fodder for cattle and goats in Kenya also has been reported.

Both the leaves and berries are used as a source of dyes. Leaves are macerated toextract a dye used to colour sisal baskets.

Pharmacological action, toxicity

150 kDa glycoprotein enhances activities of detoxicant enzymes and lowers plasmic cholesterol.

Solanum glycoprotein might be one of agents that blocks TPA-mediated signal responses in tumor cells.

Solanum glycoprotein proved to have potent anti-oxidative potential.

Ethanol extract of fruits has hepato-protective activity against CC14-induced hepatic damage in rats.

Ethanol extract of ripe fruits could be used as anti-oxidant and cancer chemo-preventive material.

Extract of stem, leaves and mature and immature fruits showed cytotoxicity to *Salmonella typhimurium* TA 100. It is also found that immature fruits extracts exhibited strong cytotoxicity with dose dependence and induced significant DNA damge in human lymphocytes based on the comet assay.

The methanolic extract of the aerial parts powder decreased the ulcer index. The activity may be due to inhibition of acid and pepsin secretions.

The ethanol extract of the whole plant show cytoprotective against gentamicin- induced toxicity kidney cell (Vers cells).

It is proved that fruits of *Solanum* have neuropharmacological activity which the extract significantly prolonged pentobarbital induced sleeping time, produced alteration in the general behavior pattern, reduced exploratory behavior pattern and reduced sapontaneous motility.

Two glycoprotein were isolated from *S. nigrum*, one from leaves and stem and the other one from fruits. They are reactive with oxygen radicals, moreover the glycoproteins radical scavenging activity is sensitive to the superoxide anion radical and the hydroxyl radical. When MCF-7 cells were treated with SNL glycoprotein, nitrate oxide production was induced.

Toxicity

Most species associated with *Solanum* section *Solanum* are reputedly poisonous to both humans and livestock; many of the reports of their toxic effects are reported in the older literature.

Indeed, nearly every manual on poisonous plants in every geographical region of the world includes *S. nigrum*. The widely reported toxicity of *S. nigrum* has been attributed to the alkaloid solanine causing varying degrees of poisoning in humans, cattle, pigs, goats, ducks and chickens, with death resulting in some cases. The effects of solanine poisoning in humans are reported to be nausea, vomiting, diarrhoea, colic, headache, dizziness, loss of speech, fever, sweating and

tachycardia, reduced heartbeat, pupil dilation, blindness, mental confusion, convulsions, coma and death.

Such effects normally appear around eight hours after ingestion. In animals, such ingestion can cause rapid pulse and respiration, dark-coloured diarrhoea followed by constipation, lack of rumination, somnolence and dry muzzle in cattle, pale mucous membranes, widely dilated pupils, low body temperature, oedema, incoordination, tremors and staggering movements. However, the level of solanine, the toxin responsible for these effects, is apparently reduced if animal forage contaminated with *S. nigrum* is ensiled; the resultant fermentation process probably converts the sotanine to the less toxic sotanidine by acid hydrolysis.

Therapeutics

Liver Disorders

Solanum nigrum is most effective for liver disorders such as chronic enlargement of the liver and associated symptons, e g. haemoptesis (blood from the mouth, mucoid stools, and other skin manifestations). The juice of the plant can be taken for this.

Chronic Skin Ailments

For example Psoriasis and Ringworm, the tender plant is used as a vegetable and a paste (as a poultice) of the plant is applied locally.

Inflammatory Conditions

The plant is taken internally as a vegetable and applied externally as a paste. Alternatively the hot leaves can be applied to the swellings.

Painful periods



The leaves are used. Crush a handful of (about 20) leaves and boil the paste with _ cup of water and pinch of salt, to extract the juice. Dosage; take _ cup of boiled leaf juice, along with meals thrice a day for 5 days during menstruation. Repeat for three cycles.

Hepatoprotective

Solanum nigrum promotes liver and kidney health and has shown hepatoprotective activity in cases of toxicity induced by drugs and

chemicals. The berries are used for fevers, eye diseases, hydrophobiea.

Decoction of leaves; diuretic, laxative. Decoction of berries and flowers; prescribed in cough and cold.

The plant is effective in the treatment of cirrhosis of the liver and also credited with emollient, diuretic, antiseptic and laxative properties.

List of Diseases:

Haemoptesis, mucoid stools, skin manifestations, swellings, fevers, diarrhoea, eye diseases, hydrophobia, cough and cold

Pharmacopoeias

Solanum nigrum L. plant has been found in the Indian Pharmacopoeia

Latin Name	:	*Solanum nigrum* Linn. (Soalnaceae)
English Name	:	Black night-shade
Sanskrit Names	:	Kakamachi, Kakahva
Hindi Name	:	Makoi

History:

It has been used from earlier times in Ayurveda along with other ingredients in heart disease. It is also stated that the berries of this plant can be eaten without danger.

It appears to have been used chiefly by the Greeks as a local application to inflamed parts.

In Persia it has been described to be useful in dropsy and as a diuretic. Most Arabian and Persian writers of Materia Medica describe four different kinds. Mr. M. Shariff in his supplement to the pharmacopoeia of India speaks very favourably of it as a cathartic and diuretic.

In 1890, the physiological action of solanine,the active principle of this plant, had been investigated by Max Perles. He found its action upon amoeboids, infusoria and ciliated epithelium cells to be that of a powerful protoplasmic poison.

Distribution:

Found throughout India in dry parts, up to an elevation of 2,100 m.

Habit:

S. nigrum is a herbaceous or suffrutescent weed. The leaves are ovate or oblong, sinuate-toothed or lobed, narrowed at both ends; the flowers are white, in drooping umbel-like 3-8-flowered clusters; the berries are red, yellow or black and round; the seeds are discoid, smooth, yellow and minutely pitted.

Principal constituents:

Solamargine and solasonine.

Indications:

The plant is effective in the treatment of cirrhosis of the liver. The plant is also credited with emollient, diuretic, antiseptic and laxative properties.

Product range:

Geriforte, Herbolax, Liv-52, Eve Care

Pharmaceutical preparations

The following drugs contain *Solanum nigrum* extract in their preparations:

1- Jiva sattva

It used in liver dysfunction, lack of appetite, fatty liver, hepatitis, and related complications. The drug either in the form of tea or tablets contains a mixture of about ten herbs mainly *Solanum nigrum, Tephrosia purpurea, Achyranthes aspera, Andrographis paniculata, Tecoma udanlata, Cichorium intybus, Phyllanthus urinaria, Piper nigrum* and *Zingiber officinale*



http://www.suryaherbal.com/liver-tablets-syrup.html

2-Herbokam:

The drug used as Antistress agent; used for fatigue due to overwork and insomnia due to nervousness. It provided in tablets and capsules and is comprised of 8 herbal ingredients, mainly Withania somnifera, Nardostachys jatamansi, Bacopa monierii, Evolvulus aisinoides, and Solanum nigrum.

"http://www.itmonline.org/arts/drepdisp.htm"

3- Valiliv Forte:

The general use of the drug is liver protectant in viral hepatitis. It is a syrup comprised of 10 herbs, mainly *Eclipta alba, Terminalia arjuna, Emblica ribes, Crataeva nurvala, Solanum nigrum* and *Fumaria parviflora*.http://www.shamanshop.net/store/prodpage2.cfm/CategoryID/16000.0/file.htm

4- AAROGYAM (CAPSULES):

It is used in general Weakness, antiageing ensures total healthcare.

Delicious Rejuvenation tonic for all Ages, prevents stress, increase immunity of the Body. The drug composed for mixture of 16 herb mainly Solanum nigrum, Chichorium intybus, Tereminalia arjuna, Withania sominifera and Aspargus adscendens

5- HEPTALIV SYRUP

The drug consists of a mixture of about 7 plants; *Solanum nigrum, Eclipta alba, Phyllanthus niruri urinerie, Boerhavia diffusa, Fumaria parviflora, Picrorrhiza kurrooa,* and *Andrographis paniculate. Solanum nigrum* is credited with antiseptic, antispasmodic, antidysentric, emolient, laxative.

6-Liver care

Liver Care (aka Liv.52) - Herbal Liver Support (640 mg – 90 Tablets)

ACTION

- Protects agains harmful toxins from drugs, alcohol, food, water, etc.
- Regulates levels of enzymes and optimizes assimilation.
- Improves the functional efficiency of the liver.
- Cost-effective health maintenance.

The drug consists of mainly *Capparis spinosa, Cichorium intybus, Solanum nigrum, Terminalia arjuna, Cassia occidentalis, Achillea millefolium* and *Tamarix gallica.*
"http://www.clubnatural.com/clubnatural/licalisufo18.html"

7- AESCULUS COMPOSITUM DROPS

Composition:

Aesculus, Secale cornutum, Viscum album, Tabacum, Solanum nigrum, Echinacea angustifolia, Rhus toxicodendron, Ruta, Dulcamara, Baryum, jodatum, Hamamelis, Apis mellifica, Acidum benzoicum and *Arteria.*



Indications:

Peripheral disorders of the circulation, e.g. gangrenous condition of the leg due to excessive smoking, intermittent claudication, endarteritis obliterans, arteriosclerosis, decubitus, elephantiasis, cholesterolemia, dysmenorrhea, inner ear

deafness, post embolic circulatory disorders.

Solanum nigrum is used in inflammatory swelling and chronic cirrhosis & enlargement of liver. The drug used in treatment of cirrhosis, infective hepatitis, chronic hepatitis, hepato protective, hypertrophy of liver, adjuvant therapy in malnutrition and anorexia.
http://www.hc-sc.gc.ca/hpb/drugs-dpd/product/p48676.html

8- LIVERALL (CAPSULES)

It consists from the extracts of *Andographis Paniculata*,

Picrorrhiza Kurroa, Eclipta Alba, Solanum nigrum and *Boerhavia diffusa. Solanum nigrum* is used in inflammatory swelling and chronic cirrhosis & enlargement of liver.

The drug is used in treatment of cirrhosis, infective hepatitis, chronic hepatitis, hepato protective. hypertrophy of liver, adjuvant therapy in malnutrition and anorexia
http://www.helloindya.com/sas_pharma/liverall.htm
www.helloindya.com/sas_pharma/liverall.htm

Test for purity

For testing the purity of *Solanum nigrum* drug (whole plant or leaves) the following steps must be applied:

The herb must be free from the strange material i.e. stones, animal remains, dust and other plants remains. The drug must be free from any quantity of unripe fruit for its high toxicity. If the drug is leaves only, it must be free from the other plant organs.

The total glyco-alkaloids content either in the leaves alone or in the whole plant must be within the range of its concentration because its responsibility in the pharmaceutical action of the drug.

Regional Records

The knowledge in this part have been mentioned before in the section of folk medicine and in the ethnobotany.

Economy

Solanum nigrum has not been considered as an economic plant in the Egyptian market, as vegetable crop or as a medicinal herb. In these days it is not used in the folk medicine in Egypt, but it is found on sale as a vegetable in both rural and urban markets in Africa, especially in Cameroon, Ghana, Kenya, Madagascar and Nigeria, as well as in Guatemala, New Guinea and the Mediterranean (e.g. Crete). It is also sold in the markets of

Hawaii, Trinidad, Suriname, India, Indonesia, China and the Philippines.



The plants therefore provide a source of income for rural farmers, who are mostly women. In some districts of South Africa Zulu women often take baskets of berries to sell in nearby villages or townships. Both the vegetative shoots and the fruits are probably harvested casually as weeds of other crops. There are very few reports of controlled cultivation at the edges of cultivation in parts of Kenya and *Zambia*.

Economic returns from the use of *Solanum nigrum* as a vegetable have not yet been quantified, though it was reported that the 'black nightshade' has a low market price and a low economic' value in those countries in which it is sold as a market crop.

Cultivation and its economical impact:

Up till now *S. nigrum* has been not cultivated as economical crop either in Egypt or any other countries. Therefore, it is difficult to evaluate the economical impact if its regulated cultivation for the lack of information about the price of the product as well as the demand of the market of its yield.

There is no information about the expected yield either as total herb or leaves and ripe fruits.

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عنب الديب

يتبع نبات عنب الديب الفصيلة الباذنجانية Solanaceae ويوجد منه ثلاثة أصناف هى:

var. nigrum ويوجد منتشرا فى جميع أنحاء مصر

var. incisum وينتشر بوادي النيل خاصة فى الجنوب

var. elbaensis وهو صنف متوطن Endemic ويوجد فى منطقة جبال علبة فقط.

وينتشر عنب الديب انتشارا واسعا سواء كنبات بري أو فى صورة حشائش نامية في حقول المحاصيل الزراعية المختلفة فى معظم قارات العالم أفريقيا واسيا وأوربا واستراليا والأمريكتين.

يحتوى النبات على العديد من المجاميع الكيميائية فى جميع أجزاءه (المختلفة) أهمها: الجلوكوسيدات القلويدية - الصابونينات - الفلافونيدات

تحتوى بذور النبات الناضجة على زيت ثابت نسبته تتراوح بين ٢٠ الى ٣٠٪. ولعنب الديب استخدامات طبية عديدة حيث ذكر فى كتب التراث أنه يستخدم في علاج كثير من الأمراض مثل الصداع والتهابات المعدة وكمسكن ومقوى للكبد ومدر للصفراء ويشفى من الاستسقاء وقرحة الرئتين وغيرها من الأمراض. ومما هو جدير بالإشارة إنه لا توجد له استخدامات فى الطب الشعبي بمصر وربما يرجع ذلك الى أن الثمار غير الناضجة تحتوى على مواد سامة. بينما لعنب الديب استخدامات عديدة فى الطب الشعبي فى كل من الهند ودول شرق آسيا ومعظم الدول الأفريقية وأمريكا اللاتينية وأوروبا. هذا ولقد ثبت علميا فى الطب الحديث أن النبات يحتوى على جلوكوبروتينات لها تأثير مضاد للأورام السرطانية ومضاد للأكسدة كما أن المستخلص النباتى لعنب الديب له تأثير على الجهاز العصبي وبعض التأثيرات الأخرى المفيدة. كما للنبات استخدامات أخرى غير طبية فى بعض مناطق العالم حيث ثبت انه قاتل لقواقع البلهارسيا ويقاوم السركاريا. كما يستخدم كغذاء فى بعض الدول حيث تؤكل أوراقه وثماره الناضجة وفى تغذية الحيوانات فى بعض الدول الأفريقية. كما ذكرت بعض البحوث أن النبات له القدرة على تراكم العناصر الثقيلة السامة في جسمه لذا يمكن استخدامه فى تقليل تلوث التربة Phytoremediation.

TEUCRIUM POLIUM L.

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TEUCRIUM POLIUM L.

Ja'ada **الجعدة**



***Teucrium polium* L., Sp. Pl., ed. 1, 566 (1753).**

(polium = Greek name for Teucrium polium)

Names

Arabic :الجعدة Ja'ada; Dja'ad;جوتيبه Goutiba; هايدا Haida; فلفله Felfela; شندجورة Shendgura; حشيشة الريح Hashishet er-rih; مسك الجن Misk el-gin.
English: Mountain germander; Cat thyme; Hulwort
French : Pouliot de montagne; Germandèe en capitule; Polium; Germandèe tomenteuse; Germandèe polium

Morphological Description

A polymorphic species, many subspecific taxa have been described from its range of distribution. Perennial with a woody base, 10-14 cm, tomentose-canescent or white-woolly.

Leaves 1-3 cm, oblong-linear, with 5-8 pairs of lobes; stems terete, ascending or erect, branched; leaves 1-3 cm, sessile, oblong-linear, crenate, strongly revolute; verticillasters in dense globose heads on branches 8-25(40) cm;

Flowers sessile; calyx 3-4 mm, densely tomentose, campanulate, calyx-teeth hidden by the tomentum; corolla 5-6 mm, white; stamens

slightly exserted; nutlets c. 2.2-1.5 mm, oblong, rugose, brown. It is in flower from April to August, and the seeds ripen from July to August. The scented flowers are bisexual and are pollinated by bees. The plant is self-fertile.

Geographical Distribution

Local: The Mediterranean coastal strip from the border with Libya near Sallum to Rafah, Sinai peninsula.
Global: Southern Russia, Balkans, Mediterranean region, Arabia, Iraq, Iran, Afghanistan, Somalia.

Ecology

A variable species with a number of sub-species growing in a variety of habitats from stony ground, desert wadis, sandy places near the sea to mountain ranges.

Status

The species is very common and widely distributed worldwide.

Storage:

It should be stored in dry places with good ventilation.

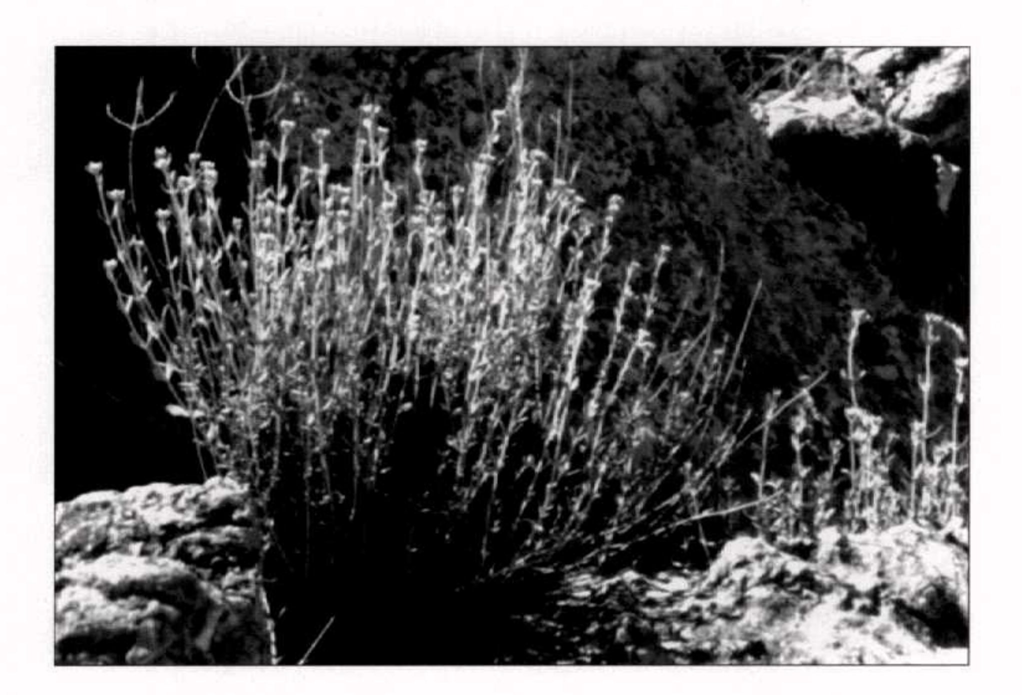
Cultivation

The plant prefers light (sandy), medium (loamy) and heavy (clay) soils and requires well-drained soil. The plant prefers neutral and basic (alkaline) soils. It cannot grow in the shade. It requires dry or moist soil. Sow the seeds at spring in a cold frame and only just cover the seed. Prick out the seedlings into individual pots when they are large enough to handle and plant them out in the summer if they are large enough. The plant can be easily cultivated by cuttings.

Chemical Constituents

The main chemical constituents are diterpenoids of different types. Clerodane diterpenoids, Neoclerodane diterpenoids, rearranged abietane diterpenoids and Furanoid diterpenoids were isolated from *T. polium.* The most important are the Clerodane diterpenoids, of specific structural features could be taken as typical of the genus *Teucrium*,

represented by compounds 1-14. Additionally, iridoids (15-17), volatile oils (0.04%, the main constituents are caryophyllene, α-, ß-pinenes, limonene and bornyl acetate) and phenolic compounds were also identified.



Folk Medicinal Uses

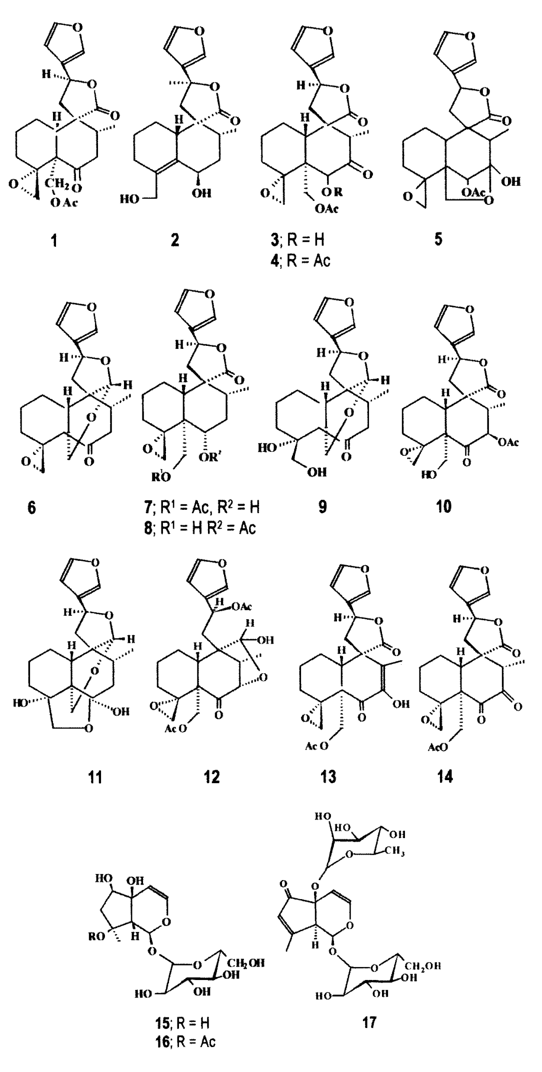
Hot infusion of tender parts of plant is taken for stomach and intestinal troubles. The plant is used in a steam bath for colds and fevers, it is also useful against smallpox and itch. The plant infusion is vermifuge, stimulant, depurative, tonic, astringent, vulnerary, useful for feminine sterility and colds. The plant extract has been used in the treatment of fungal diseases and abscesses.

Heritage Resources

It was reported by AlAntaky to be used (the infusion) as anti-poison, antipyretic and in cases of urinary retention, rheumatoid, injury healing, feminine diseases and abdominal pains.

Ethnobotany

The herb is used as tea; the plant is mixed with boiled water and sugar to form a refreshing beverage. The plant is used as a spice.


1
2
3; R = H
4; R = Ac
5
6
7; R[1] = Ac, R[2] = H
8; R[1] = H R[2] = Ac
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14
15; R = H
16; R = Ac
17

Pharmacological Action

It was found that the crude extract of leaves of *T. polium* is able to enhance insulin secretion by almost 135% after a single dose of plant extract (equivalent to 0.1 mg plant leaf powder per mL of the culture medium) at high glucose concentration (16 mmol/L). These data clearly show that the plant extract, probably without metabolic transformation, is able to reduce high blood glucose levels through enhancing insulin secretion by the pancreas.

The aqueous extract of *Teucrium polium* aerial parts, given intraperitoneally at doses from 50 to 150 mg/kg for 10 days, reduced significantly the serum levels of cholesterol and triglycerides in hyperlipidemic rats.

New studies confirm the antivisceral pain properties of *T. polium* comparable to those of hyoscine and indomethacin and suggests a good place for it in antispasmodic therapies in human. The presence of flavonoids and sterols might be responsible for the anti-inflammatory activity of this plant.



Toxicity:

It was found that *T. polium* induces hepatitis.

Therapeutics available data on the drug

Teucrium polium was traditionally used as an antispasmodic and hypoglycemic agent. A study evaluated the anorexic effect of the herb in rats, and found that administration of the herb caused a marked, dose-dependent, reversible, anorexic effect. Such studies heightened the position of *Teucrium* species in weight-loss products, especially in Europe.

Pharmacopeias

It is expected to be included in many pharmacopeias as it is globally distributed in many areas like Southern Russia, Balkans, Mediterranean region, Arabia, Iraq, Iran, Afghanistan and Somalia.

Pharmaceutical Preparations

No pharmaceutical preparations including *T. polium* have been done.

Tests for Purity

Al-Antaky stated its adulteration by Mermachour (Serw gabaly) and could be differentiated by the bitterness of *T. polium*.

Regional Records

In Morocco, it is used to treat fevers. In Israel, it is used in cases of bad digestion, diabetes, retarded menstruation and nausea. The leaves percolate is used in urinary and genital systems' infections. In Kuwait, leaves are used for intestinal pains, and malaria. In Turkey, the leaves are used to treat asthma.

Economy

1 kg dry herb costs about 100 EL.

Additional information

Species in this genus are notably resistant to honey fungus.

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الجعـدة

الوصف: نبات عشبي متخشب عند القاعدة، يصل ارتفاعه إلى حوالي ٤٠ سم؛ السيقان متفرعة بغزارة قرب القاعدة، الساق قائمة أو شبه قائمة. مغطاة بشعيرات زغبية بيضاء كثيفة، ينتهي كل فرع عليها بنورة. الأوراق مستطيلة إلى بيضاوية ضيقة أو شريطية، جالسة، طولها ١-٣ سم، قمتها شبه مستديرة، ملتفة الحواف بشكل واضح، نادرا ما تكون مستوية الحواف، مغطاة بشعيرات دقيقة وكثيفة. النورات المختلطة شبه هامية، غزيرة الأزهار، قصيرة الأعناق. القنابات شريطية إلى ملعقية، مقروضة إلى كاملة الحافة، متساوية تقريبا مع طول الكأس. الأزهار شبه جالسة. الكأس طوله ٣-٥ مم، جرسي الشكل، غزير الشعيرات، له أسنان شبه متساوية ومستديرة عند القمم، التويج أبيض أو مائل إلى الأصفر، والفصوص شبه ملساء. الأسدية قليلة البروز إلى الخارج. الثمرة مكونة من أربع بنيدقات والبنيدقات طولها حوالي ٢ مم.

وقت الإزهار: أبريل - أغسطس

التوزيع: ينتشر هذا النبات بصفة أساسية في حوض البحر الأبيض المتوسط وغرب آسيا.

البيئة: التلال الصخرية بوجه عام

الاستخدام الطبي: يؤخذ منقوع ساخن للأجزاء الغضة لعلاج آلام المعدة والأمعاء. يفيد حمام بخار للنبات في حالات البرد والحمى والجدري والحكة الجلدية. أما منقوع النبات فهو طارد لديدان الأمعاء، منبه، مطهر، يفيد في علاج العقم عند النساء، لعلاج البرد، منشط، قابض ولائم للجروح. تستخدم الخلاصة المائية للنبات في علاج الأمراض الفطرية والخراريج.

يستخدم لعلاج الحمى و سوء الهضم ومرض السكر، كما توصف الأوراق في حالات تأخر الدورة الشهرية delayed menstruation والغثيان أثناء الحمل nausea ويؤخذ منقوعها لعلاج إصابات الجهاز البولي والتناسلي و تستخدم الأوراق لعلاج حرقان الأمعاء، والبواسير والملاريا، كما تستخدم لعلاج الربو asthma.

وقد أثبتت الدراسات أن خلاصة الأوراق تحفز إفراز الإنسولين فتخفض مستوى الجلوكوز بالدم. وفي دراسة أخرى ثبت أن الخلاصة المائية للعشب تعالج السمنة وذلك بخفض مستويات الكوليستيرول والدهون بالدم.

PLUCHEA DIOSCORIDIS (L.) DC.

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PLUCHEA DIOSCORIDIS (L.) DC.

Barnoof **البرنـوف**



Pluchea dioscoridis (L.) DC.; Prodr. 5:450 (1836)

Pluchea dioscoridis A. Chev., 1920
Baccharis dioscoridis L.; Cent. Pl. 1:27 (1755)
Conyza dioscoridis Desf.;Tabl. Ecol. Bot. Ed,114 (1815)
Baccharis aegyptiaca Forssk. ex DC.; Prodr. 5:450 (1836)

Conyza (from konis, dust; because it was supposed to have the power, when powdered and sprinkled, of driving away flies).
Pluchea: named after Noel Antoine Pluche (1688-1761), a French naturalist.
Baccharis: from Greek name Bakkaris given to a plant with a fragrant root and recycled by Linnaeus. [(United Cerebral Palsy) www.ucp.org]

Names

Arabic: Barnoof برنـوف
English: Ploughman's spikenard
Marsh fleabane
French: Conyze
German: Dörrkraut

Morphological Description

Pluchea dioscoridis (L.) D.C. is a shrub, attaining a height of one to three meters and having numerous, cylindrical slightly hairy branches which are finely longitudinally striated.

The leaves are simple, dorsiventral, alternate, exstipulate and sessile with serrate margin, acute apex, reticulate venation and covered with trichomes.

The flower heads are companulate or ovoid in shape, usually sessile or showing short stalks; few inflorescences are usually arranged in stalked clusters, collected in much-branched corymbose or globose terminal panicles.

The involucral bracts are arranged in more than one row; the inner ones are linear to linear lancolate in shape, while the outer ones are usually shorter, ovate in shape and slightly hairy.

The receptacle is small and narrow, florets are pink in colour, those of the circumference are pistillate and numerous, while those in the centre are hermaphrodite and few. The pappus is arranged in one row, and consisting of numerous capillary bristles. The fruit is small, glabrous achene, having four to seven ribs.

Geographical distribution

- **Global:** The plant is widely distributed in the Middle Eastern and surrounding African countries. It has been reported to grow wildly in Angola, Burundi, Chad, Congo, Djibouti, Egypt, Eritrea, Ethiopia, Iran, Iraq, Israel, Jordan, Palestine, Kenya, Lebanon, Libya, Oman, Saudi Arabia, Qatar, Sudan, Syria, United Arab Emirates, and Yemen.
- **Regional** (Arab countries): Egypt, Saudi Arabia, Qatar, United Arab Emirates, Oman, Yemen, Jordan, Palestine, Israel, Syria, Lebanon, Iran and Iraq.
- **Local:** (In Egypt): The plant is very common and wide-spread in the Delta and Nile Valley, it has been reported in Nubia, El-Dakhla, Ballana; Kom Ombo (Aswan), El Faiyum, Suez, Boulaq el Dakrour, El-Marg, El Birka (Cairo), Ismailia and Suez, Fayid adaquar, Matamir (western Delta), Tall Hammad (60 km S from Cairo), Qabbari (Alexandria), El-Mansoura, Damietta and Menzaleh (Delta).

Ecology

Pluchea dioscoridis grows on the fine loamy soils in moist habitats, especially along the irrigation and drains, the streams and the Nile branches.

It is a Nanophanerophyte, with Sudano-Zambezian+Saharo-Sindian origin.

The nutrient status of *Pluchea dioscoridis* is relatively low. The general trend of most nutrients in the organs is; leaf>flower>stem>root, and the organic components is; crude fiber>total carbohydrate>total protein> ether extract.

Significant negative correlations were found between the concentration of most elements in the leaves and the concentration of the same elements in the soil.

Status

The plant is very common and has a wide geographical distribution. The plant is considered as an invasive species which can rapidly and seriously degrade the quality of wild lands by altering natural processes and reducing biodiversity.

Storage

Plant materials are stored in bags, protected from insects, but it is better to be stored in a well-closed container to preserve the volatile oil, protected from light at room temperature. The use of a desiccant is recommended to minimize the humidity.

Chemical Constituents

Many active constituents have been reported in the different parts of the plant. These can be summarized as follows:

1- Volatile constituents

The leaves contain volatile oil (0.28-5%). It was analyzed by GC/MS where 112 compounds were detected, consisting mainly of Sesquiterpene hydrocarbons (mainly; ß-Maaliene and α-Elemene), oxygenated sesquiterpenes (mainly; α-Cadinol, Muurolol and Caryophyllene oxide isomer).

2- Flavonoids

Many flavonoids have been reported; quercetin-4'-glucoside, quercetin-7-arabinoside, quercetin-3-rutinoside, quercetin-3-O-ß-D-glucoside, quercitrin, quercetin, Isorhamnetin-3-O-rhamnoside, isorhamnetin-3-O-rutinoside, kaempferol-3-rutinoside, apigenin-6,8-di-C-glucoside. In addition, four sulfated flavonoids; 3,7-disulfates of quercetin, isorhamnetin, and kaempferol, the 3-sulfate of isorhamnetin.

3- Triterpenoid

Hexacosanol, octacosanol, and tetracosanol, ß- amyrin, α-amyrin, ß-amyrin acetate, lupeol acetate, cholesterol, campesterol, stigmasterol, ß-sitosterol and ß-sitosterol-ß-O-D-glucoside were obtained from the hexane fraction.

4- Sesquiterpenoid

A crystalline principle conyzin, 0.1%, isolated from the leaves, which was latterly identified as a sesquiterpene lactone. Many other sesquiterpenoid compounds have been isolated from the aerial parts of the plant. These include:

A- Eudesmanes

1ß,6α-Dihydroxy-7-epi-eudesm-3-ene
1ß,6ß-dihydroxy-7-epi-eudesm-3-ene
1ß,6α-dihydroxy-7-epi-eudesm-4(15)-ene
1ß,6ß-dihydroxy-7-epi-eudesm-4(15)-ene

B- Eudesmanoic acid derivatives

5ß-hydroxy-7-epi-eudesm-4(15),11(13)-dien-12-oic acid
5α-hydroxy-7-epi-eudesm-4(15),11(13)-dien-12-oic acid
15-hydroxy-7-epi-eudesm-4,11(13)-dien-12-oic acid
15-oxo-eudesm-4,11(13)-dien-12-oic acid
4ß,5α-Dihydroxy-15-oxo-eudesm-11(13)-en-12-oic acid
4ß,5ß-Dihydroxy-15-oxo-eudesm-11(13)-en-12-oic acid

C- Guiane derivatives

4ß,6ß,10ß-trihydroxy-1α,5ß(H)-guaiane
4ß,6ß-dihydroxy-1α,5ß(H)-guai-10(14)-ene
4ß,6ß-dihydroxy-1α,5ß(H)-guai-9-ene

D-Xanthane derivative:

6α-hydroxy-1,4,1α,5α-diepoxyxanth-10(14)-ene

E- Eudesmanolides (sesquiterpene lactones)

1ß-hydroxy-9α-hydroxy-α-cyclocostunolide
1ß-angeloyloxy-9α-hydroxy-α-cyclocostunolide)
11- 1ß,9α-Dihydroxyeudesm-3,11(13)-dien-5α,7α-12,6-olide
1ß-angeloyloxy-9α-hydroxyeudesm-4(15),11(13)-dien-5α,7α-12,6-olide
1ß,9α-dihydroxyeudesm-4(15),11(13)-dien-5α,7aα-12,6-olide
2α-Hydroxyeudesma-4,11(13)-dien-12,8ß-olide 2-O-ß-D-xylopyranoside

F- Other constituents
Pluchecin
Thiophene derivatives

Folk Medicinal Uses

In Egypt the decoction of the fresh **leaves** is used as a remedy for treatment of cold, colic and as carminative.

In Tanzania, the plant is used by traditional healers in the northeastern parts for:

- A decoction of **root** bark and cooking fat (a few drops) drunk against sterility in women and impotence in men.
- A decoction of the **roots** to treat colds.
- The roots and **leaves** are a stimulant, comforting medicine and an aromatic.
- A decoction of the **leaves** is used for curing children and infantile ailments.

Heritage Resources

Ibn El Bitar and Al Antaki reported the use of Barnoof in the treatment of epilepsy in children, in colic, as carminative and as remedy for cold.

Ethnobotany

Many trials have been conducted to confirm the ethnobotanical uses of *Pluchea dioscoridis*. These can be summarized as follows:

1- Activity against stored grain pests

The crude extract of *Conyza dioscoridis* (*Pluchea dioscoridis*) has been tried, with significant degree of success, as a botanical post-harvest insect deterrent or protectant against stored grain pests. The chemical structures of compounds present in it were found by gas chromatography/mass spectrometry to include predominantly esters of long-chain fatty acids, such as hexadecanoic, arachidonic, and octadecanoic.

2- Effect on some biological and technological aspects of silkworm

Study of the effect of the antibiotics (vibramycin and streptomycin) and the volatile oils of (barnoof *Conyza dioscoridis* (*Pluchea dioscoridis*) and *jasmine zifir Clerodendron inerme*) on some biological and technological aspects of silkworm *Bombyx mori* L. infected with (*Bacillus thuringiensis*) and noninfected ones revealed that the percent larval mortality and

duration significantly decreased while the fecundity, hatchability, emergence and cocoon production increased when the larvae were treated with the antibiotics or volatile oils either separately or when they were combined together. In addition, treatments increased the weight of shell cocoon, silk content ratio, weight and size of filament. However, concentrations higher than 30 ppm caused adverse effects on either the biological and technological characters of infected mulberry silkworm.

3- Mosquito larvicidal activity

The volatile fractions obtained by hydrodistillation of the fresh leaves of *Pluchea dioscoridis* showed a marked mosquito larvicidal activity against *Culex pipiens*.

Pharmacological action and toxicity

1- Antinociceptive effect

The methanolic extract of the aerial parts of *Conyza dioscaridis* (*Pluchea dioscoridis*) showed antinociceptive effect in mice. The effect was studied using acetic acid-induced writhing and tail-flick test in mice. Oral administration of 400 mg/kg methanolic extract significantly inhibited the nociception to acetic acid-induced writhes with a protection of 85.5-61.3%. In the tail-flick test, the methanolic extract produced significant increase in the latency to response of tail to thermal stimulation.

2- Antidiarrheal activity

The antidiarrhoeal activity and effect on the motility of the isolated rabbit's duodenum of the methanol extract of *Conyza dioscoridis* (*Pluchea dioscoridis*) was investigated.

Oral administration of the methanolic extract of (200 mg/kg) dose exhibits a significant antidiarrheal effect against castor oil-induced diarrhea. The methanol extract induced a dose-dependent (0.4-2.8 mg/ml) relaxation of rabbit's duodenal smooth muscle.

However, a ganglionic blocking effect appeared to be a possible mechanism of action since a stimulant dose of nicotine could not restore the contractile response of the tissue.

3- Hypoglycaemic effects

The extract of *Conyza dioscoridis (Pluchea dioscoridis)*, was given orally to normal rats, it showed hypoglycaemic effects.

4- Antibacterial activity

The volatile constituents of this plant had promising antimicrobial activities against some tested micro-organisms.

5- Antiparasite Activity

Myiasis is one of the most important parasitic diseases, which affects the human welfare. The volatile oil of *Conyza dioscoridis (Pluchea dioscoridis)* was tested against adult *Lucilia sericata*. The LC50 was 180 ppm.

Toxicity

The plant may cause allergic dermatitis due to its content of the allergenic eudesmanolides.

Pharmacopeias:

Not available

Pharmaceutical Preparations

A hair care preparation ***"Rosemary & Peppermint Detangler"*** is marketed in USA. The oil of *Conyza dioscoridis (Pluchea dioscoridis)* is included as one of the ingredients of the formula.

The company claims that this lightweight formula detangles and conditions hair without weighing it down.

Tests for purity

1-Macroscopic identity

based on shape, size, colour, surface characteristics, texture, and fracture characteristics.

2- Microscopic inspection of the broken or powdered materials.

The powdered leaves are brownish-green, having aromatic odour and bitter taste. It is characterized by the presence of fragments of epidermis showing thin sinuous anticlinal walls and anomocytic stomata. Abundent glandular and covering trichomes are present. Covering trichomes are uniseriate, multicelluar (3-8 cells). Glandular trichomes have bicellular biseriate stalks and biseriate multicellular heads.

3- Microbiological

The test for *Salmonella* spp. should be negative. The maximum acceptable limits of other microorganisms are as follows: For preparation of decoctions: aerobic bacteria; not more than 107/g; fungi; not more than 105/g; *Escherichia coli*; not more than 102/g. Preparations for internal use: aerobic bacteria; not more than 105/g or ml; fungi; not more

than 104/g or ml; enterobacteria and certain Gram-negative bacteria; not more than 108/g or ml; *Escherichia coli*; 0/g or ml.



4- Total Ash

Not more than 14.3%.

5- Acid-insoluble ash

Not more than 2.7%.

Economy

Not available data.

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البرنـوف

نبات عشبي يتبع العائلة المركبة يصل ارتفاعه الى ٣ أمتار ،. و يتميز برائحة عطرية و أوراقه بسيطة بيضاوية ذات حافة مسننة. الأزهار ذات لون قرنفلي وحيده أو ثنائية الجنس.

النبات شائع الإنتشار فى منطقة الشرق الأوسط و البلدان الأفريقية المحيطة بها. أما فى مصر فينمو البرنوف فى الدلتا و الفيوم بجوار قنوات الرى و الصرف و فروع النيل فى التربة الطينية الغنية بالمواد العضوية و الرطوبة العالية.

يحتوى البرنوف على العديد من المكونات الكيميائية ، تم التعرف على بعضها و يمكن تقسيم هذه المكونات كالآتى:

١- الزيت الطيار: نسبته حوالى ٢.٨٪ و يتركب أساسا من مواد سيسكويتيربينات هيدروكربونية و مؤكسدة.
٢- مواد فلافونية حرة أو جلايكوزيدية و يحتوى بعضها على مجموعات كبريتية.
٣- تيربينات ثلاثية و مواد ستيرولية.
٤- مواد سيسكويتيربينية من نوع الإيوديسمان أو الجوايان بالإضافة إلى لاكتونات الايوديسمان و مشتقات من حمض الإيوديسمانويك.

فى مصر يستخدم مغلى النبات الطازج لعلاج البرد و المغص و كطارد للغازات. و فى تنزانيا يستخدم النبات فى العديد من الوصفات العلاجية حيث يغلى قشرة جذر النبات مع بعض قطرات من الزيت و تستخدم لعلاج العقم عند النساء و العجز الجنسى للرجال كما يستخدم مغلى الجذور لعلاج البرد و يستخدم مغلى الأوراق و الجذور كمشروب منبه كما يتم استخدام مغلى الأوراق لعلاج حالات القلق للأطفال و حديثى الولادة. و قد أورد كل من ابن البيطار و الأنطاكى استخدام البرنوف لعلاج الصرع عند الأطفال و لعلاج المغص و طارد للغازات و لعلاج البرد.

كما يستخدم نبات البرنوف لحفظ الحبوب بعد جمعها و لزيادة انتاج الحرير و قاتل ليرقات الناموس و يستخدم الزيت الطيار للبرنوف كأحد مكونات تركيبة للعناية بالشعر فى الولايات المتحدة الأمريكية.

تم اجراء العديد من الدراسات الفارماكولوجيةعلى البرنوف و وجد أن مستخلص الكحول المثيلى لها تأثير مقلل للاحساس بالألم و مضاد للإسهال و خافض لنسبة السكر فى الدم كما وجد أن للزيت الطيار تأثيرمضاد للميكروبات و مضاد للطفيليات.

قد تؤدى ملامسة البرنوف إلى حالات من الحساسية الجلدية نتيجة لإحتوائه على لاكتونات السيسكويتيربين.

يتم اختبار نقاء النبات عن طريق الفحص الظاهرى للنبات كاملا و الفحص الميكروسكوبى لمسحوق النبات (خلايا البشرة و أنواع الشعيرات).كما يجب أن يتخطى المعايير البكتيريولوجية.

كما يجب ألا يزيد الرماد الكلى عن ١٤.٣٪ و الرماد الذى لا يذوب فى الحمض عن ٢.٧٪.

SOLENOSTEMMA ARGHEL (DEL.) HAYNE

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SOLENOSTEMMA ARGHEL (DEL.) HAYNE

Hargal **الحرجـل**







Solenostemma arghel (Del.) Hayne, Getrue Darstell. Gew. 9, t. 38 (1825).

Synonyms

Cynanchum arghel Delile, MÈm. Egypte 3: 319 (1802).
Cynanchum oleifolium Nectoux, Voy. Egypte 20 (1808).
Solenostemma oleifolioum (Nectoux), Bullock & E. A. Bruce, Kew Bull. 8: 359 (1953)

Names

Arabic : Hargal الحرجل
English :Argel, Arghel
French : Solenostemma, Arguel
German : Arghelsenna

Morphological Description

The diagnostic features:

Solenostemma arghel (family Asclepiadaceae) is an erect perennial, desert under shrub reaching a height of 0.6-1.00 m, nearly glabrous with many blue-green fine under-velvety pubescents. Branches are rigid, erect and leafy.

Leaves 2-4 cm long, coriaceous and rigid when dry, glaucous, elliptical lanceolate, acute and have a velvet-like pubescence. White flowers are in axillary umbel-like cymes with short peduncles; bracts are linear-lanceolate and acute. The pubescenct calyx consists of five separate sepals and the corolla subcampanulate of five white petals; are 7-10 mm long.

Fruits about 5 cm long, oblong to ovate, smooth, stout, beaked, very hard of a dark purple colour. Flowering yearly from September to April. Seeds are turgid, ovoid, channelled down one face, minutely tuberculated, bearing one apical tuft of hairs.

Related species

Asclepias sinaica (Boiss.) Muschl., Man. Fl. Egypt 753 (1912).

Syn. *Gomphocarpus sinaicus* Boiss., Diagn. Fl. Orient., ser. 1, 11: 80 (1849).

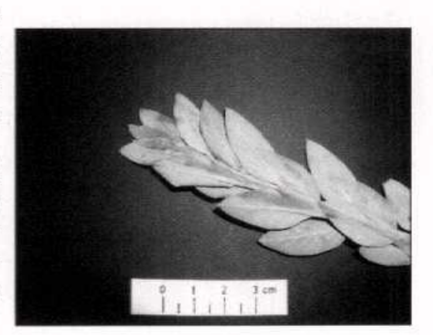
Caution: The milky latex of *Asclepias sinaica* is a deadly poison when it reaches the blood vessels and mouth, and hence it is used only to treat skin fungal diseases.

The diagnostic features of *Asclepias sinaica:*

Asclepias sinaica is an erect desert perennial, greenish-yellow shrub reaching a height of 0.5-1.2 m with milky latex; juvenile growth densely white-tomentose, becoming less tementose on adult parts.

Stems many from the base, simple, spreading, leafy; leaves 3-8 x 0.4-0.8 cm, linear-lanceolate, the apex acute, the margin revolute, the base attenuate; petiole 2-4 mm.

Flowers in axillary pedunculate umbels, much exceeding the leaves; corolla 1.5-2.4 cm broad, yellow, the lobes broadly ovate, acute; corona without teeth; follicle lanceolate, tapering to a beak, tomentose, with pinkish soft bristles and longitudinal white green stripes; fruit reddish, mealy-pubescent between the soft spines;



seeds comose. Common in Sant Katherine, rare in El-Tih and the region North of Wadi Tumilat.

Parts Used

- Dried leaves
- Numerous erect stems contain latex and are commonly found admixed with the leaves in commercial drug, in variable amounts of 10 to 40%.

Macro- and microscopical description of *Solenostemma arghel* leaf
Type: Simple leaves, opposite, decussate.
Colour: Yellowish to grayish-green.
Taste: Slightly acrid, mucilaginous and bitter.
Texture: Thick, rigid and coriaceous.
Margin: Entire but revolute.
Apex: Acute.
Base: Symmetric.
Surface: Slightly pubescent, occasionally with yellowish patches of dried latex.
Epidermis: Striated thick cuticle, striations more distinct around the base of hairs, outer tangential walls thick and slightly mucilaginous.
Upper epidermis: 20-26-36 microns in length, 14-16-20 microns in width and 6 -7-14 microns in height.
Lower Epidermis: 16-20-27 microns in length, 8 -12-16 microns in width and 5 -6-12 microns in height.
Stomata: Ranunculaceous, very few rubiaceous, measuring from 24-30-32 microns in length and 16-20-26 microns in breadth.
Hairs: Simple , warty, non-glandular, multicellular, uniseriate, of 2-4-8 cells, usually not curved, arising from one, occasionally two epidermal cells, and measure from 33-108-170 microns in length and from 12-30-40 microns in diameter at the base. Cicatrix, rounded, thick, non-lignified.
Palisade: Upper, of 3-5 rows, lower; of 2-3 rows; cells from 10 -16-26 microns in length and from 4 -7-14 microns in breadth.
Mucilage: Little in the outer walls of the epidermal cells.
Laticeferous structure: Present as cells and tubes in mesophyll and phloem; tubes narrow, ramifying through mesophyll, terminating at epidermis.
Calcium oxalate: Rosettes, few clusters: rosettes measuring 14-26-33 microns in diameter, with dark non crystalline centers.
Pericycle: Parenchymatous.
Fibres: Absent.
Perimedullary phloem: Present.

Geographical distribution

Global :Saharo-Sindian Region with extension to the Sahelian domainfloristic category and Saharo-Arabian Region.

Regional :Egypt, Sudan, Libya, Algeria, Morocco, Palestine, Arabia, Chad and Niger.

Local :Sinai (El-Tih and the region North of Wadi Tumilat; Rafah; Wadi El-Arish) and the Southern Eastern Desert (Hurghada; Wadi Umm Sider; Edfu; Mersa Alam Road; Wadi Hangalia; Wadi El-Gemal ; Wadi Umm Hargel and Wadi Allaqi).

Ethnobotany

The plant is used in by the two culturally distinct Bedouin groups living in different areas of the Eastern Desert of Egypt, the Bischarin and the Khushmaan Ma'aza.

The data documented that Argel is used for medicinal purposes but not for food, grazing, fibres, oil, fuel-wood and cosmetics.

Ecology

Solenostemma arghel grows on pebbly and gravelly habitats in the wadis of Sinai and Southern Eastern Desert. It is a typical desert evergreen undershrub which extends its vegetative activity to cover at least three years of a rainless periods. In dry periods some individuals in the population shed the leaves and even small branches but others remain evergreen throughout the vegetative period. Reproductive activity is high in the third year of the life during the period from September to June. The reproductive capacity of individuals of the same age cohort varies greatly, branching increasing with age.

Flowers start to appear in September in few individuals, those flowering individuals increasing gradually in the six months from September and reaching the reproductive flowering/fruiting stage until April, which is the end of flowering season.

Fruits are ripening during April and June; ripe fruits open and the seeds scatter. *Solenostemma arghel* plant could be described as "drought resistant", which strategy includes perennials that maintain some photosynthesis throughout dry periods and have reserves of water and energy. They are more conservative in the use of their own resources, especially moisture, which in turn enables them to extend their activities under conditions of moisture stress.

The sites in Wadi Allaqi and Wadi Umm Harigel (Wadi Umm Hargel

takes its name from the name of the plant itself) in which *Solenostemma arghel* grows, are primarily alluvial in origin with some aeolian deposits.

Analysis of soils supporting argel contain: Zn (13.4 mg kg^{-1}), Cu (4.9 mg kg^{-1}), Se (0.02 mg kg^{-1}), Mn (163 mg kg^{-1}), Fe (60 mg kg^{-1}), K (30%), Na (0.75%), Ca (0.90%) and Mg (0.24%).

Status

Solenostemma arghel is threatened. It is heavily collected from its natural habitats to be sold in the Attarin shops all over Egypt. Large amounts of the leaves are imported from the Sudan.

Due to the fact that it became rare in some places especially in Sinai due to over-collection, the native healers use the leaves of *Asclepias sinaica* (Syn.= *Gomphocarpus sinaicus*) as a substitute of the argel leaves. They call both hargal, which is wrong and may be harmful.

Cultivation:

Field experiments in downstream part of Wadi Allaqi showed that germination and fruiting were faster in sandy soil than in clay soil, also the number of fruits and seeds were higher. The germination percentage was higher in clay soil than in sandy soil and the seedlings were longer. Seedlings survive and grow better in nurseries (66.7 %) than in experimental farms (62.96 %).

Laboratory experiments at controlled conditions showed that the seeds of the plant germinate under wide range of temperature (20-40° C in Petri-dishes and 25-40° C in soil).

The results of this study showed that a temperature of 35° C was the most favourable for the germination in both Petri-dishes and soil. This indicates a specific thermal adaptation of the plant to prevailing high temperature throughout the year. Pre-sowing treatment of seeds with growth stimulators in different concentrations caused higher germination percentages than in untreated seeds at 25° C, while no change was observed at 35° C.

The best germination was reported in seeds treated with Thiourea 5 ppm (92.5%) at 25° C. Seeds soaked in water at room temperature for one hour before sowing gave a higher germination percentage (80 %), while no germination were reported for the seeds which were soaked in hot water at 57° C for ten minutes.

Another experiment has been done to evaluate its responses to different irrigation regimes in two seasons. The experiment revealed that short irrigation intervals and the 80 to 100kg N/ feddan gave the best growth, yield and glycosides contents. The results are represented in **Tables 1-4**.

Table (1): Effect of irrigation and nitrogen fertilization treatments on growth parameters of Argel grown on the desert soils during the second growth season (2000/20001).

Treatments	Plant height cm	No. of leave per plant	No. of branches per plant	Leaves (g/plant)		Stems (g/plant	
				Fresh weight	Dry weight	Fresh weight	Dry weight
Irrigation (days)							
5	28.66	197.50	10.50	20.65	7.28	14.32	5.02
10	19.58	69.33	4.08	10.94	3.72	8.73	2.98
15	13.16	56.41	3.08	9.24	3.24	6.54	2.10
20	9.00	27.41	2.0	2.53	0.84	1.43	0.67
Nitrogen (kg/feddan)							
No (zero)	7.81	19.93	1.12	4.88	1.68	3.21	1.04
N1 (100)	22.43	103.25	6.68	13.92	4.77	9.15	2.83
N2 (150	22.56	139.81	6.93	13.73	4.86	10.91	4.21

Table (2): The combined effect of irrigation and nitrogen fertilization treatments on growth parameters of Argel grown on the desert soils during the second growth season (2000/20001).

Treatments		Plant height cm	No. of leaves per plant	No. of branches per plant	Leaves (g/plant)		Stems (g/plant)	
Irrigation (days)	Nitrogen (Kg/feddan)				Fresh weight	Dry weight	Dry weight	Fresh weight
5	**No (zero)**	12.50	26.25	2.00	4.05	1.52	3.05	0.98
	N1 (100)	34.25	223.25	14.75	30.43	10.28	15.84	5.28
	N2 (150)	39.25	343.00	14.75	27.49	10.05	24.07	8.81
10	**No (zero)**	10.75	31.00	2.50	5.65	2.14	4.63	1.47
	N1 (100)	27.25	89.00	5.00	14.11	4.58	11.57	3.43
	N2 (150)	20.75	88.00	4.75	13.07	4.46	10.00	4.05
15	**No (zero)**	4.50	12.25	1.00	8.47	2.65	4.35	1.41
	N1 (100)	18.00	68.75	4.00	8.78	3.37	7.68	2.08
	N2 (150)	17.00	88.25	5.25	10.49	3.70	7.60	2.81
20	**No (zero)**	3.50	10.25	1.00	1.36	0.43	0.82	0.31
	N1 (100)	10.25	32.00	3.00	2.38	0.86	1.51	0.54
	N2 (150)	13.25	40.00	3.00	3.87	1.25	1.97	1.18

Table (3): Effect of irrigation and nitrogen fertilization treatments on pregnanes and pregnane glycosides percentage of leaves and stems of Argel grown on the desert soils during the second growth season (2000/20001).

Treatments	Pregnanes and pregnane glycosides in leaves (%)	
	Leaves	Stems
Irrigation (days)		
5	0.80	0.85
10	0.95	1.11
15	1.06	1.17
20	1.19	1.23
Nitrogen (kg/feddan)		
No (zero)	0.95	1.13
N1 (100)	1.03	1.10
N2 (150)	1.02	1.04

Table (4): Combined effect of irrigation and nitrogen fertilization treatments on pregnanes and pregnane glycosides percentage of leaves and stems of Argel grown on the desert soils during the second growth season (2000/20001).

Treatments		Pregnanes and pregnane glycosides (%)	
Irrigation (days)	Nitrogen (kg/feddan)	Leaves	Stems
5	**No (zero)**	0.67	0.75
	N1 (100)	0.86	0.83
	N2 (150)	0.86	0.98
10	**No (zero)**	0.94	1.24
	N1 (100)	0.87	1.07
	N2 (150)	1.03	1.02
15	**No (zero)**	0.96	1.23
	N1 (100)	1.13	1.20
	N2 (150)	1.09	1.09
20	**No (zero)**	1.23	1.32
	N1 (100)	1.24	1.29
	N2 (150)	1.09	1.07

Tissue culture:

Seeds of argel were sterilized in T-Chloramine for 15-20 minutes and germinated on Murashige-Skoog medium (1962), solidified with 0.6 % agar.

The explants of leaves, apical and axillary buds were inoculated in Erlenmeyer flasks containing 25 ml medium each, and incubated in semi-climatised culture room (24° C, 1000 1ux illumination, with a 16 hour light period).

Seven hormonal variants were used and the passage rhythm was of six weeks. Both the callus and shoots showed a capacity for synthesizing some medicinal compounds including polyphenols, flavones, carotenoids, pigments and phytosterols **(Table 5)**.

Table (5): Active pharmacological compounds identified in Solenostemma arghel.

Solenostemm arghel samples	Flavones Rutoside g%	Polyphenols Catechin g%	Carotenoids ß-carotene mg%	Phytosterols ß-sitosterol mg%
Leaves (control)	0.4675	0.3250	2.9000	50.3700
Callus	0.3011	1.3030	2.4790	10.1480
shoots	0.4300	1.3840	16.8230	40.9300

Solutions for conservation:

The remoteness of the upstream part of Wadi Allaqi area, the very scarce population, and the absence of a good connection to the nearest market in Aswan have protected the population of *Solenostemma arghel* plant in this area. The suggestions for conservation are as follow:

1- Ethnobotanical studies should be encouraged which represent basic studies to help implementing conservation programmes.
2- The collection of *Solenostemma arghel* should be controlled by the resident people.
3- Cultivation and propagation of *Solenostemma arghel* in ecologically suitable habitats.
4- Establishment of seeds bank and preserving the seeds in suitable conditions to avoid the infection of insects and fungi.
5- Sustainable development for the wadis in which *Solenostemma arghel* grows.

Collection:



Solenostemma arghel leaves are collected during all the year but the best period for collection is after the fruiting stage (April). At this stage, leaves contain large amount of pregnanes glycosides derivations, which increase their biological activities. The ideal method of collection as follow:-

1- Hang branches of about 8-10 stems in a warm (but not hot), well ñventilated, dark place. Make sure that stems and leaves are not too tightly packed together. This will enable air to circulate freely.

2- Separate leaves from the stems by carefully rubbing the branches over a large sheet of plain paper.

3- Pour the dried leaves from the paper into a dark glass jar carefully with a screw top or a brown paper bag.

Storage:

A warm dry place is ideal for preserving *Solenostemma arghel*. Leaves should be stored in sterilized dark glass containers with airtight lids. It may be stored in new brown paper bags that must be kept dry and away from light.

Metal and plastic containers are inadvisable because they may contaminate the leaves. Make sure that the container you use is labeled with the plant name, source, and date of collection. Keep a sharp eye out for insect infestation. Sterilize the container and check contamination.

Chemical Constituents

The phytochemistry of *Solenostemma arghel* has been investigated by many authors, with differing results but the main constituents are pregnane-type derivatives.

• **Monoterepene glycosides:** 6,7 - dihydroxy - dihydrolinalool -3-*O*-ß-glucopyranoside and 6,7-dihydroxy-dihydrolinalool-7-*O*-ß-glucpyranoside

• **Pregnane derivatives and Pregnane glycosides** (approximately 0.84%):

- Three polyhydroxypregananes named 14ß-15α-dihydroxyprogestrone;

3ß-14ß-15α-16ß-hydroxy-20-oxo-pregnene-tetra-ol; 3ß-14ß-dihydroxy-17ßH-pregn-5-en-15-one and 14beta,15alpha-dihydroxy-Delta(4)pregnen-3,20 dione were isolated.

- Three pregnane glycosides named 14ß-hydroxy-15α-(ß-D-glucopyranosyloxy)-preg-4-ene-3,20-dione **(Stemmoside A)**; 14ß-hydroxy-15α-(ß-D-glucopyranosyloxy)-17ßH-preg-4-ene-3,20-dione **(Stemmoside B)** and pregn-5-ene-3, 14-ß-dihydroxy-7, 20-dione-3-*O*-ß-glucopyranoside.
- Seven 14, 15-secopregnane glycosides which are characterized by the presence of two hemiketal functions involved in two five-membered rings and named **Argeloside A - G (6-12)** were isolated.
- Nine 15-keto pregnane glycosides, namely **Stemmosides C - K**, were isolated. **Stemmosides E - J** are characterized by the occurrence of an uncommon 14ß proton configuration while stemmosides E and F possess in addition a rare enolic function in C-16. On the other hand, stemmosides G - J display an unusual C-17α side chain. **Stemosides E-K (e.g. 1-5)**.

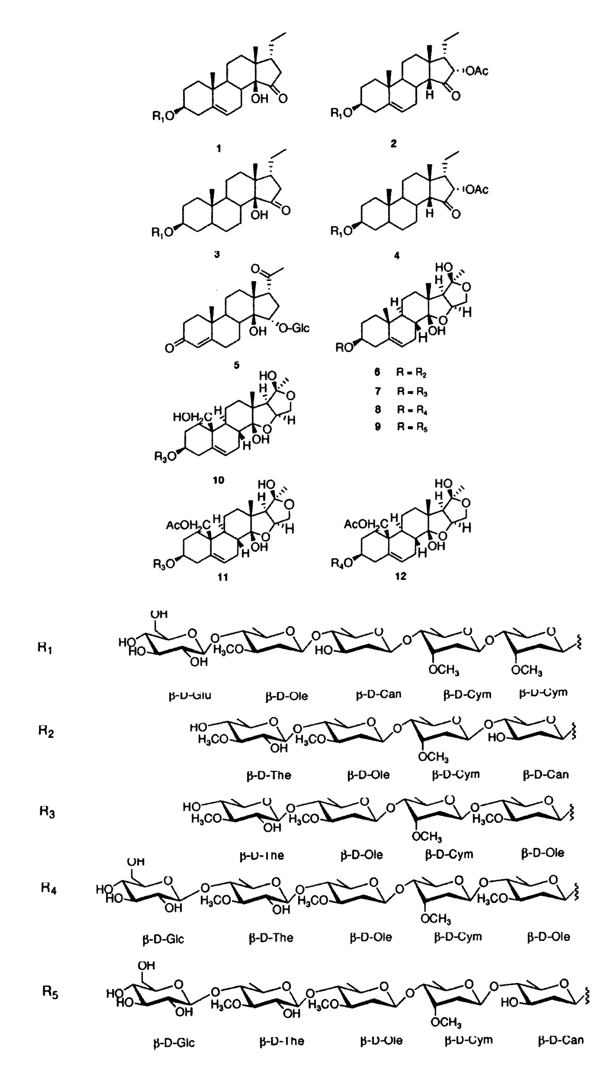
• **Acylated phenolic glycosides:** Benzyl alcohol-*O*-ß-apiofuranosyl-(1⟶6)-ß-glucopyranoside and 2-phenylethyl-*O*-α-arabinopyranosyl-(1⟶6)-ß-glucopyranoside.

• **Phytosterols and terpenes:** ß-sitosterol, dihydroxstigmasterol, ethoxy vangurolic acid, ß-amyrin and α-amyrin.

• **Bases:** Choline

• **Flavenoids:** Kaempeferol-3-*O*-ß-glucopyranoside (astragalin), Kaempeferol-3-*O*-α-rhamnopyranoside, quercetin, rutoside, catechin.

Elemental analysis: Na (3.40 %), Ca (2.26%), K (39.50%), Mg (11.45%), Mn (216 mg kg^{-1}), Fe (402 mg kg^{-1}), Zn (73.7 mg kg^{-1}), Cu (32.7 mg kg^{-1}), Se (0.4 mg kg^{-1}). Recommended dietary allowances for the adult male from Fe, Zn, Cu are 100, 150, 20-30 (mg kg^{-1}) respectively.



1
2
3
4
5
6 R = R2
7 R = R3
8 R = R4
9 R = R5
10
11
12
R1
β-D-Ole
β-D-Can
β-D-Cym
R2
β-D-The
β-D-Ole
β-D-Cym
β-D-Can
R3
β-D-Ole
β-D-Cym
β-D-Ole
R4
β-D-Glc
β-D-The
β-D-Ole
β-D-Cym
β-D-Ole
R5
β-D-Glc
β-D-Can

Folk medicinal uses and Indigenous knowledge

In Egyptian folk medicine, the plant is used as a purgative, antipyretic, expectorant, antispasmodic, and in cases of bile congestion. It is used to treat neuralgia and sciatica. Infusion of leaves for gastro-intestinal cramps, stomachic, anticolic, for colds, urinary tract, antisyphilic if used for long period of 40-80 days.

Methods of preparation

Infusion

An infusion is the simplest way to prepare the more delicate leaves of *Solenostemma arghel*. It is made in a similar way to tea and is prepared as follows:-

1- Place the powdered dry leaves (about 10 g) in the strainer of the tisane cup and place the strainer in the cup. Fill the cup with freshly boiled water.

2- Cover the cup and infuse for 5-10 minutes before removing the tisane strainer. Add a teaspoonful of sugar or honey to sweeten if desired.

Pot infusion

Warm the pot, then add the powdered dry leaves (about 10 leaves). Pour in water that has just boiled, replace the lid, and infuse for 10 minutes. Strain some of the infusion into a cup. A teaspoonful of sugar or honey may be added if desired.

Decoction

A decoction involves simmering the leaves in boiling water and it is prepared as follows:-

1- Place the powdered dry leaves (about 10 g) in a saucepan. Cover with cold water and boil it. Simmer for about 20-30 minutes, until the liquid is reduced by about one-third.

2- Strain the liquid through a sieve into a jug. Pour the required amount into a cup, then cover the jug and store in a cool place.

In the Sudanese folk medicine, they have it as drink or directly as powdered leaves.

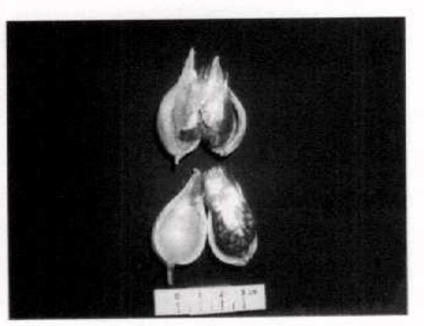
Pharmacological actions

Leaves possess purgative properties and are infused to treat gastro-intestinal cramps, stomach-ache, colic, and urinary tract infections.

In vitro and animal studies

Anti-inflammatory action of *Solenostemma arghel* was investigated, where an unsaponifiable fraction of the plant stems, showed potent anti-inflammatory activity greater than that of phenylbutazone in paw oedema test. The effect was dose related.

The topical anti-inflammatory activity of *Solenostemma arghel* leaves was evaluated using the Croton oil ear test in mice. A bioassay-guided fractionation procedure led to a highly active chloroform extract: at 300mug/cm(2), it induced 73% oedema reduction, while the reference drug indomethacin (100mug/cm(2)) induced 56% reduction. 14beta,15alpha-dihydroxy-Delta(4)pregnene-3,20 dione and kaempferol-3-O-rutinoside showed anti-inflammatory activity comparable to that of indomethacin.



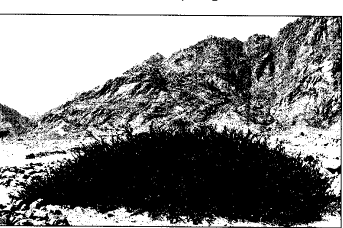
Antitumour/cytotoxic activities have been documented and were attributed to various pregnane glycosides constituents. The effect of these compounds on the VEGF-induced in Kaposiís sarcoma cell proliferation was tested. Results indicated that all the compounds reduced the cell proliferation in a dose dependent manner. In our study we observed that pregnane glycosides isolated from *Solenostemma arghel* start inducing cell death at concentrations over 20 mM or at concentrations higher than 1mM or 0.1mM. In order to obtain more information about the cytotoxicity of these unusual compounds, and as a part of our ongoing research on antiproliferative constituents of medicinal plants, we are investigating their possible effect on the process of cell death, either necrotic or apoptotic.

The plant is used for the treatment of viral B and C hepatitis, as immuno-stimulant, and in the treatment of hypercholesterolemia.

The effects of the chloroform-methanol (CM) (1:1V/V) and the chloroform (C) extracts of *Solenostemma arghel* leaves were examined on the spontaneously contracting rabbit jejunum and rat uterus. CM (400 µg/ml) produced a biphasic effect on rabbit jejunum: an initial reversible inhibition followed by delayed and sustained inhibition. CM also suppressed the activity of the uterus and the effect was not antagonized by cimetidine, haloperidol or propranolol. Furthermore, CM exhibited local anaesthetic activity when tested on the foot withdrawal reflex of the frog. The C extract stimulated rat uterus contraction. This effect was antagonized by atropine or cyproheptadine.

A weak antibacterial and antifungal activities were observed with extracts prepared from commercial samples of leaves.

Extracts from *Solenostemma arghel* leaves were obtained using petroleum ether, ether, methylene chloride, methylene chloride-methanol, methanol, methanol-water and water and tested against *Aspergillus candidus* and *Penicillium lanosum*. Differences in toxicity were found with extracts used against spore germination of both species. petroleum ether and ether extracts were ineffective as fungitoxicants. Lower concentrations of other extracts were stimulative to *Aspergillus candidus* and suppressive to *Penicillium lanosum*. The effective extracts were inhibitory at higher doses, with maximum inhibition manifested by methylene chloride-methanol fraction. Chemical characterization of this fraction revealed the presence of 5 flavonoids, of which kaempferol-3-glucoside and kaempferol-3-diglucosides. Although the sole application of the isolated flavonoids was inhibitory to spore germination, however the combined presence appear to be stimulative for the spore germination.



Methanolic extracts of aerial parts of the medicinal plant *Solenostemma arghel* growing in Saudi Arabia, incorporated into rearing media of *Culex pipiens* L. showed effect on oviposition, egg hatchability and larval viability. Acute toxicity of Argel extract was found to possess LC(50) of 0.037, 0.031, 0.009 and 0.007 ppm and the LC(95) was found 0.394, 0.293, 0.065 and 0.030 ppm, after 1, 2, 4 and 7 days against the larva of *Culex pipiens* under laboratory conditions. The ovicidal effect of S. argel was relatively less pronounced, however, the 0.1% concentration reduced egg hatch by 33.7%. The mortality of the newly hatched larvae, reared from eggs in this media, reached 100% at concentrations as low as 0.025%, 2 days post hatching. Complete suppression of oviposition within the first 2 days was observed, however its action was gradually lost thereafter. Bioactive effects were mainly attributed to the presence of a variety of bioactive organic substances mainly terpenes, pergenine glucosides, alkaloids and sterols.

Four compounds (A-D) have been isolated from the stems of *Solenostemma arghel* growing in Libya. These compounds have been subjected to a preliminary screen for potential antimicrobial activity against selected organisms of gram-positive and gram negative type by serial dilution technique. The negative results of all four compounds against *Pseudomonas aeruginosa* were not unexpected and only compound C showed reasonable antibacterial properties against both gram positive and gram- negative organisms **(Table 6)**.

Table (6): Minimum inhibitory concentration of four potential antibacterial substancesa

Compounds	*Staphylococcus aureus*	*Escherichia coli*	*Pseudomonas aeruginosa*	*Proteus sp.*
Penicillin G	0.016	14	500	No test
Compound A	250	250	-	-
Compound B	500	-	-	-
Compound C	125	250	-	250
Compound w2	250	500	-	-
oxytetracycline	0.13	0.5	8	No test

a Units: mcg/ml
- negative result

Side-effects and toxicity

Excessive doses may cause nausea, vomiting and diarrhea. The milky latex is reported to be irritant. No scientific evidence was found to justify the plant uses.

Do not take during pregnancy.

Pharmacopeias

Not available for *Solenostemma arghel*, but there some pharmacopeias for related plant such as *Asclepias tuberosa*. The pharmacopeias from this plant are:

- BHP 1983.
- PDR for Herbal Medicines 2nd edition .

Diseases

Solenostemma arghel is used for the treatment of allergies, liver and kidney diseases. It is an effective remedy for cough and bronchitis. It is used in the form of incense in the cure of measles, and sometimes crushed and is used as a remedy for supporting wounds. It is used for treatment stomach cancer (Sudanese folk medicine)

Pharmaceutical preparations

There is no pharmaceutical product but there is some products from related plants such as *Asclepias tuberosa* (GSL). This herb is native to southern USA.

Test for purity

The dried powdered leaves were subjected to sublimation and to aqueous and alcoholic extractions, and products examined. The following findings are obtained:

Sublimation:

The leaves on sublimation gave white dense fumes which condensed on a cold surface giving a brown viscous liquid. After a while irregular solid yellow particles appeared in the sublimate.

Moisture: Average 9.1 - 9.3 %.
Ash: 13.25 -14.8 %.
Acid-insoluble ash: 4 - 5.4 %.
Water-soluble ash: 1.25 - 1.46 %.
Total nitrogen: 3.25 - 3.40 %.
Total protein: 20.31 - 21-25 %.
Crude fiber: 12.15 - 13.00%.

Extractives:

Using the Egyptian Pharmacopoeia methods (1953), the following results of extractives were obtained:

- Petroleum-ether (b. p. 70-80°C) extractive: 6.38 %.
- Ether extractives: 7.55 %.
- Volatile ether-soluble extractives: 0.45 %.
- Non-volatile ether extractives: 7.10 %.
- Chloroform extractives: 1.48 %.
- Acetone extractives: 19.89 %.
- Alcohol (96%) extractives: 31.5 %.
- Dilute alcohol (45%) extractives: 22.84 %.
- Water extractives: 25 %.

Detection of the major constituents (pregnane and pregnane glycosides):

The detection of pregnane and pregnane glycosides is usually difficult as no diagnostic test or specific reaction for their identity is so far known. Colours observed with non-specific reagents such as chloroformic $SbCl_3$ and 50% H_2SO_4, although widely used for their detection, are never reliable and conclusive. Still, there are some diagnostic reagents and reactions which are used for characterization, such as the Liebermann-Burchardt and Carr-Price tests for steroids. The presence of sugar(s) in these glycosides is established by the Molisch test. 2-Deoxy-and 2,6-dideoxyhexoses are characterized using the xanthyydrol test, Webb's test, vanillin-perchloric acid reagent and Keller-Kiliani test while presence

of normal (2-hydroxy) sugars is detected by Partridge and Feigl tests.

HPLC is a very efficient technique used for the detection and isolation of pregnane glycosides and is commonly applied as a last step in the purification process. HPLC using reverse phase packing material is also being successfully employed for isolation purposes by using CH_3CN and water as eluent.

Regional and other records

In the Sudanese folk medicine, the natives prepare decoctions from the leaves and branches for the treatment of various colics and pains. Also, it is used for the treatment stomach cancer (two tea spoons per day from dry leaves taking by mouth).

The leaves were formerly used to adulterate senna and are considered to be medicinally important in Libya and Chad where a decoction is used to treat neuralgia and sciatica.

Asclepias tuberose L. root is stated to possess diaphoretic, expectronat, anti-spasmodic and carminative properties. It has been used for bronchitis, pneumonitis, influenza, and specifically pleurisy.

Economy

The price of *Solenostemma arghel* leaves from 10 shops in Aswan Governorate ranges between 5 to 8 Egyptian pound per Kg and the average of the amount sold in each shop per month is 33 kilograms. It is one of the most expensive medicinal plants that grow in Wadi Allaqi conservation area, Egypt.

The important risks are:-

1- Harvesting the plant requires careful planning to make sure that the leaves are processed in peak condition and fast enough to retain their active ingredients (June-September).

2- Collecting material from unhealthy plant that have some fungi infections, insect damage. It is important to discard any damaged leaves.

3- Using nylon sacks for collecting plants. It is important to use a wooden tray or an open basket for collecting plant materials.

4- Preserving methods should be in dry conditions and dark glasses.

Economical impact:

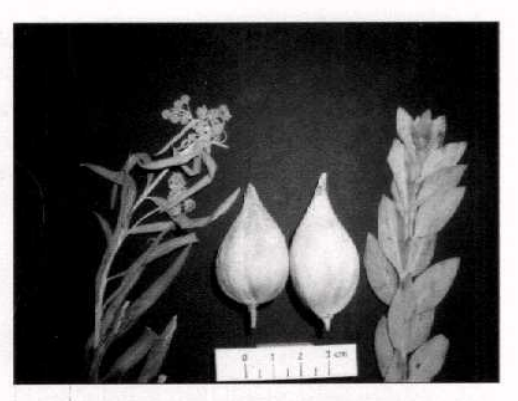
Solenostemma arghel was considered to have the highest medicinal value among the medicinal plants growing in the Eastern Desert and it

has an excellent price in the market.

In addition, it contains a diversity from the bioactive constituents and it has recently a biological effect against cancer.

This encourages the farmers to cultivate it. Also, it produces a large quantity of seeds which have an apical tuft of hairs. This feature helps the seeds to spread easly and gives a high percentage of germination when water is available.

So, cultivation doesn't need a great effort. Also, the plant gives a large mass production from leaves. From all above mentioned it is believed that *Solenostemma arghel* has a high economic impact.





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الحرجل

• **الوصف النباتي:** نبات الحرجل (حرجل بحرى– فرنجون – حردجل) من النباتات المعمرة التي تنتمي إلى العائلة العشارية والتي يصل ارتفاعها إلى متر، ذو لون أزرق مخضر ومظهر أوراقها قطيفى الملمس زغبي يحمل شعيرات في طور التزهير والثمار. الأوراق اهليجية رمحية، الأزهار بيضاء تخرج في نورات خيمية ذات عنق صغير تحمل في أطراف الأفرع. الثمار بيضية جرابية ناعمة صلبة ذات لون داكن تنشق طوليا من جانب واحد وبها بذور وبرية بها خصلة قمية من الشعيرات والنبات يفرز عصارة شفافة عند قطعه. ويزهر النبات في الربيع والصيف.

• **التوزيع الجغرافي:** ينتشر النبات في بعض أودية الصحراء الشرقية الجنوبية، كما يوجد في بعض أودية سيناء.

• **الاستخدامات الطبية:** تستخدم أوراق الحرجل في الطب الشعبي لعلاج المغص كما أنها تخلط مع نبات الحلفابر لعلاج التقلصات خاصة آلام المسالك البولية، علاج السعال، كمسهل. كما يستخدم في السودان لعلاج سرطان المعدة.

• **طريقة الاستخدام:** مغلي الأوراق ومنقوعها لعلاج السعال والمغص وكذلك كمسهل. مغلي الأوراق مع الحلفابر ومنقوعهما لعلاج التقلصات خاصة آلام المسالك البولية.

• **المواد الفعالة:** برجنان عديد الهيدروكسيل، جليكوسيدات برجنانية وفلافونيدات وبعض الجليكوسيدات التربينية الأحادية.